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NEWSLETTER

FALL 1998

AFMRC Celebrates 10 Years!

Rick Atkins, Manager, AFMRC, Lethbridge

The Alberta Farm Machinery Research Centre (AFMRC) has just celebrated its 10th anniversary, marking its growth and reputation as a first class machinery research and development facility. The facility was established in 1975 as the Lethbridge station of the Prairie Agricultural Machinery Institute (PAMI). In April of 1988, it became part of the Engineering Services Branch of Alberta Agriculture, Food and Rural Development. From its roots in evaluation, the expansion into research and development was a natural progression that has allowed the Centre to evolve along with the machinery industry. For the staff at the Centre, primarily engineers and technologists, working with the latest technology is very rewarding. It has been a period of growth with many new challenges. The list of accomplishments are many.

Consider the following stats in AFMRC's 10-year history:

- Evaluations - 145
- Research projects - 99
- Development projects - 156
- Fabrication projects - 34
- Computer/Electronics projects - 57
- Trade shows - 30
- Facility tours by students, producers, and researchers from around the world - 100+
- Evaluation reports sent out each year - 1000+
- Presentations to producers, students, and technical conferences - 200+
- Direct client consultations - 4000+
- 2.5 megabytes of information on *Ropin the Web*

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Alberta
AGRICULTURE, FOOD AND
RURAL DEVELOPMENT
Engineering Services

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The purpose of this newsletter is to advise of activities and projects being conducted by Alberta Agriculture, Food and Rural Development's Engineering Services and Regional Agricultural Engineering staff. For further information on these projects and other engineering related activities contact:

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The most significant figure is $1.3 million. It is the direct contribution by industry and other agencies toward research and development projects at AFMRC during the last 10 years. In-kind funding by industry would, at the very least, double this number. The value of engineering research back to industry is estimated at 20 times the amount invested.

What has been the result of this work and activity? Machinery and technology used by producers today. When it comes to seeding, fertilizing, tillage, spraying, tractor performance, monitors, controllers, wind/solar applications, and much more, AFMRC has made a difference. Be it a direct impact on the design and use of that equipment, or an indirect impact by setting the standards of performance. The overall winner is the producer who has access to some of the best equipment and technology available, much of it Canadian made. With machinery and equipment ($8.1 billion in Alberta) being second to land in value of farm investment, it is the single most important input in keeping the producer competitive and sustainable.

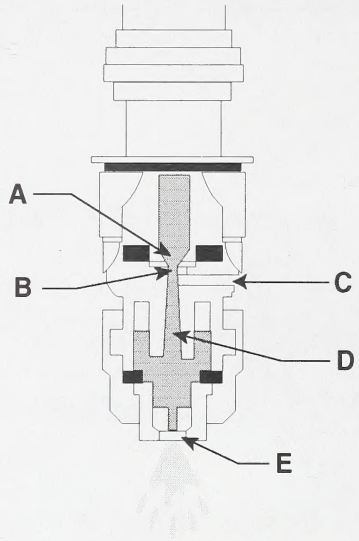
Why does industry look to AFMRC? Whether it is a producer, inventor or manufacturer, they want information that is unbiased and reliable. AFMRC is building its success on meeting that need.

Air Induction, Air Venturi, Air Bubble Jet Nozzles .... Confused?

Brian Storozynsky, Project Technologist, AFMRC, Lethbridge

Just as producers and custom spray applicators had started to use and feel comfortable with extended range and low drift nozzles, along comes the introduction of air induction, air venturi and air bubble jet nozzles. Alberta Farm Machinery Research Centre (AFMRC) personnel were flooded with questions regarding spray drift, coverage, and efficacy. It seemed all these had to be addressed before the 1998 spraying season. What a task!

The air nozzles are new to North America, though European farmers have been using them for some time. Early versions used compressors to pump air into the nozzle chamber. AFMRC tested this type of nozzle in the early 1990's, but did not like the idea of having compressors and air hoses attached to each nozzle. Today's air nozzle is based on the same principle, but uses a venturi to introduce air into the nozzle tip. The result is a nozzle tip that fits into existing nozzle caps.



The diagram shows how the air nozzles work. The spray solution passes through a tapered passage **(A)** in the nozzle. As the passage diameter decreases, the spray is accelerated through. At the tapered passage outlet **(B)**, a vacuum is created, causing air to be sucked from outside the nozzle tip through one or two holes **(C)**. The spray solution and air are mixed in the chamber **(D)** before exiting the nozzle tip **(E)**. The compression inside the mixing chamber results in air bubbles forming inside the liquid spray droplets. This produces larger spray droplets that, according to some nozzle manufacturers and distributors, have a positive affect. Spray drift can be reduced significantly without sacrificing spray coverage and chemical efficacy.

AFMRC has been testing these technologies for drift and distribution uniformity under lab conditions. It will be another six months before all the nozzles and

combinations of settings are done to complete the database information. The efficacy trials were completed this past season. At least two more trial seasons are required to determine differences in weed kill and eliminate errors due to growing conditions.

Seeding Research Projects Started at AFMRC

Lawrence Papworth, Project Engineer, AFMRC, Lethbridge

The 1998 crop season saw the start of two new seeding research projects. One study will determine the effect of row spacing and seeding rates on emergence and crop yields. The other project will examine the effect of using liquid and granular fertilizer, at various placements and rates, on emergence and crop yields.

Research on the agronomics of wider row spacing has shown mixed results. In most studies, wider row spacing did not affect yields. Some of the reported benefits include better residue clearance, lower soil disturbance, and reduced machinery cost. Sites for this project were located near Coaldale, High River, and Edmonton. Barley and canola were seeded at three rates. The Barton double shoot angle disc opener was used at row spacings of 8, 10 and 12 inches. Visual observations of the plots showed no difference between the row spacings.

Liquid fertilizer manufacturers claim that applying liquid fertilizer during seeding results in increased emergence. Research in this area is very limited. Reduced or no separation of seed and liquid fertilizer will result in redesigning double shoot openers used for liquid fertilizer. Barley and canola were seeded at sites near Coaldale and Edmonton. Openers used for this study were: a sideband double shoot with a 1 x 1" separation; a sideband double shoot with 0.5 x 0.5" separation; a narrow row hoe single shoot; and a partial ribbon spread single shoot. All openers were fabricated and supplied by Flexi-coil. Applied fertilizer rates were 0, 40, 80, and 120 lbs/ac.

The canola plots for both projects had poor overall emergence and were discarded. The High River site was hailed out on July 7, 1998. The row spacing project is expected to continue for two or three more years while the liquid fertilizer project will continue if necessary. Data collected from both projects will be analysed later this year.

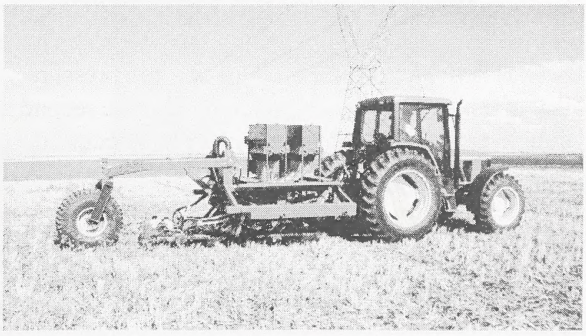
AFMRC Develops a New Plot Air Seeder

Blaine Metzger, Project Technologist, AFMRC, Lethbridge

As seeding research needs have dramatically changed over the past few years, AFMRC found it necessary to fabricate a new plot seeder for the 1998 crop year. Aside from the ability to participate in new and leading edge research, some of the main reasons for building the seeder were to:

- have openers easier to change,
- allow easy changing of row spacing,
- allow many combinations of seed and fertilizer metering for single and double shoot openers.

The seeder consists of four metering boxes mounted on top of a 3-point hitch frame. The back of the seeder is supported by a castor wheel. A subframe, mounted below the main frame, carries the openers. This subframe can be easily changed by raising the main frame and rear castor wheel with the 3-point hitch. The subframes are built with no midframe cross members, allowing the row spacing to be easily changed. A Raven controller is used to regulate the rate of the seed, granular, and liquid fertilizers. The meters are driven by electric motors and the rates are infinitely adjustable from the tractor cab. A liquid fertilizer system was also mounted on the unit.



Trelleborg Tire Tests

Reed Turner, Project Engineer, AFMRC, Lethbridge

Can large flotation tires compete with or even replace radials as primary traction tires? In cooperation with, and funding from Trelleborg, Firestone, Goodyear, New Holland, John Deere and Flexi-coil, AFMRC is comparing Trelleborg tires with similar size and capacity radial tires. They are examining power delivery efficiency, load carrying capability, flotation, and power hop control.

Marketed in Canada since 1994, Trelleborg tractor tires are advertised as being less expensive than large radials, having better power delivery efficiency, and fewer power hop concerns. To evaluate these claims, AFMRC is using two 360 horsepower four-wheel drive New Holland 9682 tractors. One is equipped with 750/65-38 dual Trelleborg tires while the other tractor will switch between three sets of similar radials - 710/70 R38 duals, 20.8 R42 triples, and 2.8 R42 duals.

Each tire set has been tested at light, medium, and heavy ballasted weights of 100, 110 and 120 lbs. per engine horsepower. At least two tire pressures have been tested at each weight. One at a tire pressure recommended by the manufacturer and the second at double that pressure. When power hop occurred, the pressure setup needed to control it was also tested. Each pressure setup was run in three different gears and repeated twice in four different soil conditions. In total, approximately 900 test runs have been conducted.

What have we learned? It appears that Trelleborgs are poorer than radials in power delivery efficiency, slightly better in load carrying capability, equivalent to radials in flotation, and better in power hop control. A full report will be written when the tests are completed.

Application of Manure on Forages

Blaine Metzger, Project Technologist, AFMRC, Lethbridge

In order to effectively manage manure use on forage land, producers need information about application rates, timing, and the effects of application on soil and forage quality. AFMRC is currently studying the application of liquid hog and solid beef manure to forage crops. Its goal is to examine the agronomic and environmental impact of spreading manure on forage crops.

Sites chosen for the project are a timothy crop near Airdrie and an irrigated alfalfa crop near Coaldale. The alfalfa site was started in 1996 and the timothy site in 1997. Cooperators for the project are Michelle McKinnon, Murray Green, Dr. Barry Olson, and Brian West from AAFRD; Troy Ormann from the County of Lethbridge; Dr. Lyle Rode and Dr. Chi Change from Agriculture and Agri-Food Canada. Funding for the project comes from the County of Lethbridge, Municipal District of Rockyview, Foothills Forage Association, Canada-Alberta Beef Industry Development Fund, and the Canada-Alberta Hog Industry Development Fund. The land for the alfalfa site was donated by Herman Schimanski.

Manure was applied in the spring and fall at available nitrogen rates of 0, 60, 120, 180, and 240 lbs/ac. The liquid manure is injected into the soil and the solid manure is spread with a conventional spreader. Yield samples were taken prior to the main harvest. Soil samples were taken from each plot in the spring and analysed for nutrient content, pH and electrical conductivity. The forage samples are analysed for protein, acid detergent fibre, selenium, and trace elements.

Yield results from the study show a significant response to manure by the timothy crop. A visual response to manure by the alfalfa crop was also observed, but the data has not yet been analysed. The project is expected to conclude in the year 2000.

Exclusion Traps for Bertha Army Worms

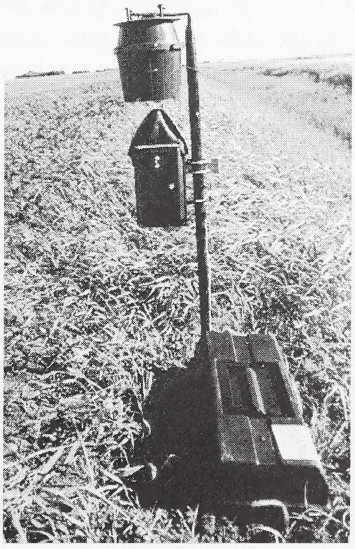
Darryl Slingerland, Project Engineer, AFMRC, Lethbridge

Since 1985, the federal and provincial departments of Agriculture have conducted a monitoring program for a variety of insect pests. Data collected from this program is compiled into maps, providing an early warning system for impending outbreaks. This gives producers a preventive advantage, saving thousands of dollars in lost crop yields. One such destructive insect is the Bertha Army Worm, which feeds on canola. Traps used for the monitoring program in the Peace River Region were found to fill with bumble bees, particularly queen bees. The catch levels made Bertha Army Worm monitoring impractical, and as a result, the Peace Region has been excluded in the Bertha Army Worm maps.

The Peace Region grows approximately one million acres of canola each year. A conservative estimate of the damage done by a Bertha Army Worm infestation puts the cost at $21.25 per acre, or $5,312,000 for the Region. This is based on an assumption of 25 percent of the crops being infested, a significant loss of revenue for producers. An early warning system, like the monitoring program, would eliminate many crop losses.

A recent severe infestation of Bertha Army Worms, along with favourable conditions for increasing population levels and damage, convinced the North Peace Applied Research Association (NPARA) to do something. They started a project to find a way to monitor the traps effectively, and also enhance the most commonly used "Unitrap" with pheromone lures. Other cooperators in the project include the Smokey River Applied Research and Demonstration Association (SARDA), the Canola Council of Canada, and Alberta Agriculture, Food and Rural Development (AAFRD).

One of the proposed monitoring systems to be tested was an exclusion trap that would close during the day, when bees are most active, and remain open from dusk to dawn, when Bertha Army Worm Moths are most active. The Alberta Farm Machinery Research Centre (AFMRC) was asked to design an exclusion trap and build several prototype units. An effective trap had to operate on low power consumption so it could be battery-powered for the duration of the monitoring period (about eight weeks) without recharging. There could be no obstruction of air flow through the trap opening, as the effective area of the pheromone lure was determined by this air flow. The unit also had to be as economical and as simple as possible.



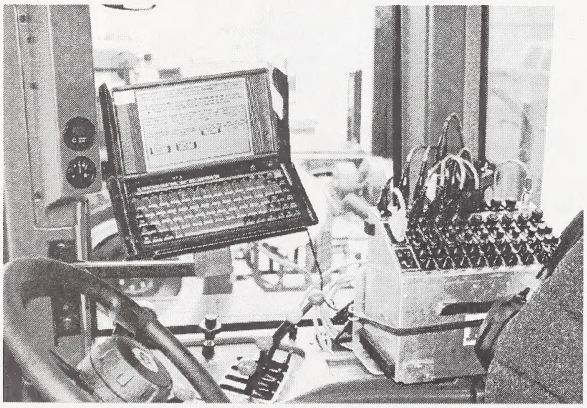
AFMRC came up with a design that uses a motor (activated by an infrared sensor and small circuit) and threaded rod assembly to close the trap. In the open position, the trap is virtually identical to the standard trap. To close the trap, the motor turns the threaded rod which pushes a plastic rod up against the trap, forcing the bottom portion of the trap up against the trap lid.

A prototype was built and successfully tested in the lab. Eleven more units were constructed and sent to NPARA for their 1997 monitoring season. Researchers involved in the project experienced some operational problems. The necessary modifications were made and the traps have been set up in the field for the 1998 monitoring period.

AFMRC 16-Channel Data Acquisition System

Reed Turner, Project Engineer, AFMRC, Lethbridge

What does the widget do? How much does it do? What happens when we change something? Faced with questions like these, AFMRC engineers use measurements to be able to understand and refine machine performance. The measurements usually involve data acquisition - the process of producing and recording electronic signals to represent machine performance parameters. Combining transducers for force, pressure, speed, temperature, acceleration, etc., a data acquisition system can give an engineer powerful insight into machine processes and functions.



AMFRC has had a variety of data acquisition systems, both large and small. With the development and use of a prototype system in 1997 and the build of two more systems in 1998, a new 16-channel Onboard Data Acquisition System has brought a sophisticated new range of capabilities to the Centre's measurement skills. The 16-channel system consists of a computer and a data acquisition box designed and built by AFMRC. The data acquisition box provides the power supply for transducers, does frequency to voltage conversions, helps in the calibration, converts analog voltages to digital readings, and serves as a central cable connection point for as many as 16 different signals. It supplies digital readings to any standard personal computer - laptop or desktop.

Software on the computer is a major part of the onboard system. It controls the system and handles scaling, storing, and plotting of data values. Data measurement is done as scans - samples taken sequentially from all specified channels at the maximum rate followed by a pause. The scan rate is adjustable. Test data sampling can be started, stopped, restarted or ended, either from the computer with a keystroke, at a remote location with a switch, or logically when a specified channel reaches a specified level. At the completion of a test run, a summary of the data is displayed. It can be immediately stored on disk, plotted and reviewed, or discarded.

Data is stored in the standard AFMRC test file format. The files interface with the Centre's existing data acquisition and plotting programs, and can also be read with standard spreadsheet, database, or word processing programs. With more than 300 different sensors and a data acquisition system, AFMRC can measure or monitor almost any function, process or event.

Questions???? Feel free to contact us at:

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ESP and White Mold Control in Edible Beans

Brian Storozynsky, Project Technologist, AFMRC, Lethbridge

Melroe's Energized Spray Process (ESP) was introduced to Western Canada in the spring of 1997. Flooded with questions regarding the system's effectiveness, AFMRC conducted efficacy and drift tests, comparing the ESP system with conventional air venturi nozzles and air assist spraying. Drift tests were conducted in Strathmore and efficacy studies were conducted in Bow Island. A Strathmore area farmer provided AFMRC with a sprayer.

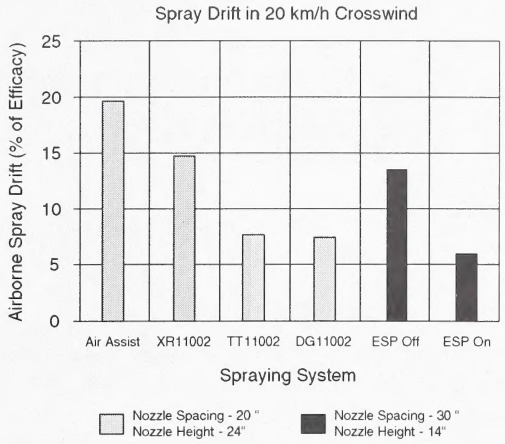
How it Works

The ESP charging system operates off the Spra-Coupe's 12-volt battery and uses standard nozzles. It delivers 40,000 volts to the chemical solution before it reaches the nozzles. By charging the chemical solution, an electrostatic field is created between the nozzle and the crop. According to the manufacturer, an electrostatic field increases the spray droplet velocity and deposition surrounding the plant leaf for more thorough coverage. This results in less spray drift and more chemical on the intended target.

Drift Results

The graph shows the effectiveness of the ESP system by comparing the airborne spray drift results with conventional and air assist spraying. Conventional spraying setups included extended range XR11002, wide angle Turbo TeeJet TT11002, and drift guard DG11002 nozzles. Drift tests were conducted in a wheat crop that was 250 mm (10 in.) high. The sprayer was operated at 23 km/h (14.5 mph) to give an application rate of 28 L/ha (2.5 gpa).

Five trials were conducted with the ESP system in wind speeds averaging 20 km/h (12 mph). Another five trials were done with the ESP system turned off to represent conventional spraying conditions. Airborne spray drift was 13.5 percent with the ESP system turned off and 6 percent with the ESP system turned on, a reduction of more than 50 percent. The ESP system was as effective as low drift TT11002 and DG11002 nozzles.



Efficacy Results

Efficacy trials were conducted on edible beans using the ESP system in comparison with conventional and air venturi nozzles, and an air assist spraying system. The experiment was a randomized block design with four replications of each spraying system. The table shows the sprayers' operating conditions and results. Benlate (benomyl) was used

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Sprayer Type	Commercial Name	Nozzle Number	Nozzle Pressure (psi)	Application Rate (gpa)	White Mold Infection (%)
None (Check)					20.1a
Conventional	TeeJet	XR11003	40	15	4.6b
Air Venturi	Turbodrop	TD110-025	60	15	6.2ab
Air Assist	Spray Air	White	20	5	1.7c
Electrostatic	Melroe ESP	Std 8001	40	5	1.9bc

to control white mold infection. The trials were done during the first fungicide application. Disease incidences were lower than normal, probably due to the cool temperatures in the spring and possible warm dry weather in July 1997. Results suggest the air assist and ESP sprayed plots had lower levels of mold infection, showing the systems were more effective than the conventional and air venturi spraying systems.

Efficacy trials in edible beans were repeated in 1998 during the second fungicide application. These results are currently being analysed.

Work Continues on Weeds and Soil Disturbance Project

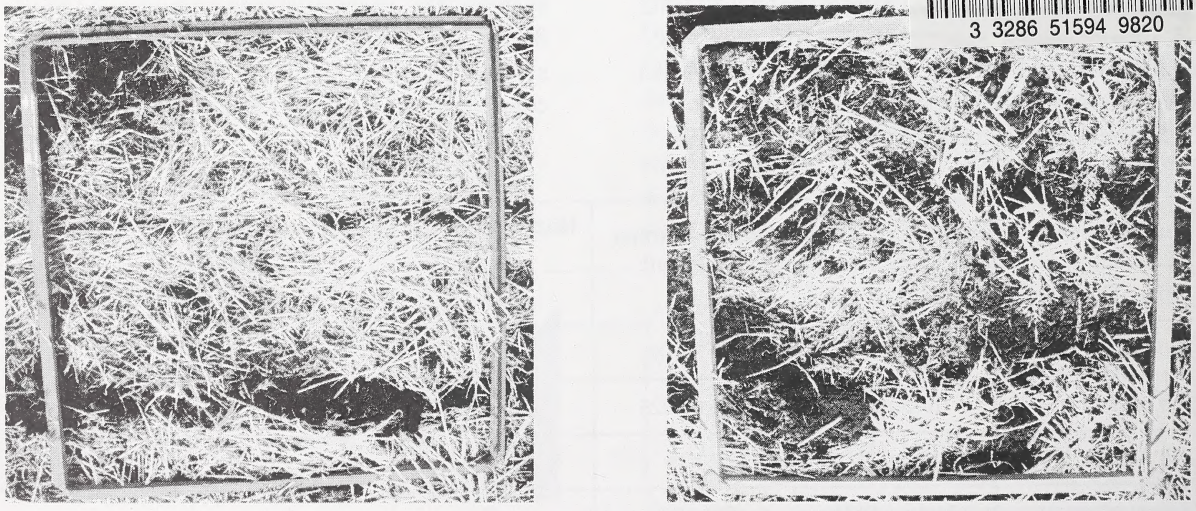
Lawrence Papworth, Project Engineer, AFMRC, Lethbridge

The "Effects of Soil Disturbance and Fertilizer Rates on Weed Populations in Direct Seeding Systems" is one of the joint research projects AFMRC is currently working on. A major constraint to the successful adoption of direct seeding is the control of weeds without tillage. This study will provide the information needed to develop integrated management systems for weed control problems in an effective and economic manner.

The 4-year project began in 1996 with study sites located near Edmonton, Balzac, Barons, and Foremost. The principal researcher for the project is Dr. Linda Hall from the Agronomy Unit of AAFRD. Cooperators for the study include: Dr. Bob Blackshaw with Agriculture and Agri-Food Canada; Dr. Ross McKenzie with the Agronomy Unit of AAFRD; AFMRC; Westco Fertilizer; Flexi-coil; Zeneca, and the County of Forty Mile.

The Centre's role in the project is to seed the plots, quantify the soil disturbance, and maintain the Foremost site. Quantifying soil disturbance has been a challenge over the last three years. A soil profile metre was developed to measure soil disturbance after seeding. These profiles did not tell the whole story. Some fully tilled (high disturbance) profiles showed less soil disturbance than low disturbance seeding methods. In 1998, a new method was used for measuring soil disturbance. After seeding, the soil was sprayed with white paint and pictures of the soil surface were taken. An image analysis system will be used to assess these pictures.

General results indicate differences in weed spectrums with changes in soil disturbance. It shows a trend of more perennial weeds with reduced tillage and more annual weeds with tillage. Weed control in the direct seeded plots has been difficult at the Foremost site. The dry weather during the last few years has made the spring burn off with glyphosate ineffective.



White painted soil surface after low disturbance (left) and high disturbance (right) seeding at Balzac site.